Democracy Dies in Darkness

Hidden Planet

When a glacier is no longer a glacier

Thousands of glaciers have already met their demise. For the first time, scientists are documenting the ones vanishing around the globe.

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By Kasha Patel

Gideon Brosowsky was excited to see his first glacier, dreaming of massive ice like he saw in the movie "Titanic." But when the incoming high school junior arrived at Alaska's Juneau Icefield on a family cruise in August, his expectations sank.

"Okay, where's the glacier?" he asked. His mom pointed to a "small, dinky piece of ice" on a mountain. He barely recognized the glacier compared with historical pictures in local museums. Even just 20 years ago, the landscape was more impressive.

"I was in disbelief," Brosowsky said. "I was assuming global warming is starting to eat away at these glaciers little by little, [but the pace was] a lot faster than I expected."

If this is underwhelming now, he said, imagine what people are going to think in a few decades. It might be gone.

But Brosowsky did not realize how many had already been lost around him. As the teen lamented one glacier's shrinking stature, at least 64 had already melted away in the ice field since 2005.

For decades, scientists have been warning that glaciers are melting — one of the most identifiable consequences of a warming planet. But now, many *have* melted.

Venezuela is now glacier-free, losing its last one this year. New Zealand has lost at least 264 glaciers. The western United States has lost about 400 glaciers since the middle of the 20th century. Swiss researchers tallied more than 1,000 small ones lost. East Africa has less than 2 square kilometers of total glacial ice remaining.

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Mountainous glaciers have vanished here and there throughout history, but the number of disappearances has skyrocketed in recent decades — when periods of unprecedented warmth melted many small, sometimes nameless, glaciers. As scientists grapple with the question of when a glacier loses its label, the change signals the long-dreaded progression of the next phase of global warming: glacial collapse.

Much like documenting an extinct species, scientists are for the first time mapping vanished glaciers worldwide brought on by climate change. It's a living list of dead glaciers.

The first funeral

On a Sunday in August 2019, around 100 people trekked two hours or so to the top of a volcano in Iceland to attend a funeral for a glacier gone from existence. The Okjökull (translating to "Ok glacier") once there was reduced to a thin, stagnant piece of ice five years earlier. It was the first glacier in the country to disappear because of climate change, but there was hardly any recognition at the time. Some people wanted to commemorate the moment loudly, even years later.

"Part of what interested us in Iceland in the first place was the paradox. How do people feel about the loss of ice when Iceland is the name of your country?" said Dominic Boyer, a cultural anthropologist at Rice University, who co-produced a documentary about Okjökull and organized the funeral with his colleague Cymene Howe.

The mourners said goodbye with moments of silence, poetry and speeches on fighting climate change. Children installed a memorial plaque at the site, inscribing the carbon dioxide in the atmosphere at the time: 415 parts per million, about 20 percent higher than in 1979.

On the plaque was a message for future generations: *This moment is to acknowledge that we know what is happening and what needs to be done. Only you know if we did it.*

Weeks later, a separate group of 250 people attended a funeral for the Pizol Glacier in Switzerland's Glarus Alps. Swiss glaciologist Matthias Huss, who has visited the small glacier more than 50 times, saw the glacier starting to fragment in 2018 after a warm year. By 2019, he no longer considered it a glacier.

You may not often find glaciologists attending a funeral for their research topic.

But Huss said the event, put on by the Swiss Association for Climate Protection, was an "interesting ceremony to commemorate the disappearance of this glacier that also [brought] quite some public interest."

The ceremonies allowed the communities to connect to frozen relics but also raised awareness for scientists to start documenting these extinct glaciers.

The funeral in Iceland, for instance, spurred glaciologists to not just assess glacier retreat but also count dead glaciers, said Howe, an anthropologist and professor at Rice University.

Scientists don't know how many glaciers have disappeared across the world, but at least some groups have started creating inventories to get a better idea. Last year, a premier database for tracking glaciers, Global Land Ice Measurements from Space (GLIMS), added an "extinct layer" with a little more than 150 extinct glaciers, primarily in the United States and Europe.

In August, Howe and Boyer created a Global Glacier Casualty List displaying 15 extinct and endangered glaciers around the world, including South America, Asia and India, some of which aren't on the GLIMS map.

Andrew Fountain, a Portland State University glaciologist, started the first inventory of glaciers in the western United States and calculated that at least 400 have disappeared since the mid-20th century.

Huss, who estimated that 1,000 glaciers have been lost in Switzerland alone, extrapolated that perhaps 10,000 glaciers might be lost globally. Chinese glaciologists say their country has lost more than 8,000.

As scientists track these changes, they must also ascertain when a glacier ceases to exist.

What classifies as a glacier

On his family cruise in Alaska, Brosowsky listened to his guide pointing out slabs of ice around Glacier Bay. Some were unmistakably large, magnificent glaciers, but others just looked like small ribbons of ice.

"It's kind of rude to the real glaciers, in my opinion, if we're calling everything a glacier like that," Brosowsky joked.

Not all ice is glacier. By definition, a glacier is essentially a moving river of ice formed from snow compaction over years. The movement flowing downhill is subtle to a person walking over it, but scientists can measure the flow with instruments, Fountain said.

If a glacier becomes too small and ceases to move, it's not a glacier anymore. In fact, the scientific label for a stagnant piece of ice is "dead." When an entire glacier is declared dead depends on the region, with size and flow thresholds varying in different countries.

Technicalities aside, there are more obvious clues that glaciers are starting to fall apart in front of our eyes.

Seeing the 'death' of a glacier

For the past 41 years, glaciologist Mauri Pelto has visited Ice Worm Glacier in the Mount Daniel-Mount Hinman complex in Washington state every year and seen its decline firsthand.

The small glacier lost mass slowly until around 2015, marked by a warm summer with relatively low snowfall. Then, starting in 2021, an unprecedented string of ice loss finally pushed the glacier over the edge. Pelto started seeing rock at the bottom, with holes in the pattern of Swiss cheese. In 2023, he declared it was no longer a glacier.

Just a year earlier, he had seen the disappearance of the bigger Hinman Glacier — after thousands of years, all that remained were a few patches of snow and ice.

"The end happened so fast," said Pelto, a professor at Nichols College. "Whether it's a pet or a person, they get near the end, a lot of things can happen really fast."

Pelto has personally seen the disappearance of 31 glaciers in the Pacific Northwest, although he is sure there are many more undocumented. He expects another one in the Mount Daniel-Mount Hinman complex, the Foss Glacier, to lose its status this year or next.

For scientists, documenting extinct glaciers can often feel existential.

"A thought occurred to me that in a few decades' time, nobody will read my papers because why bother? There are no glaciers," said Fountain, likening glacier inventory to documenting dinosaurs. "I'm documenting what was."

Theoretically, extinct glaciers can grow back. Realistically, that doesn't seem likely.

In the Pacific Northwest, Pelto said, snowfall would need to increase by at least more than 20 percent on average for many years, as well as cooler summers. Considering Earth has been on a record hot streak for more than a year, that doesn't seem in the cards.

“The ongoing disappearance of the smallest glaciers is not something we can just turn around, even if we stop [carbon dioxide] emissions today,” Huss said. “It’s too late for the small glaciers.”

But, he said, it might not be too late for the bigger ones.